

This Method of Operation was prepared from Issue 26 of drawing ES-207197

METHOD OF OPERATION

PANEL SYSTEM  
STARTING CIRCUIT  
FOR USE WITH PANEL LINE FINDER  
BATTERY GROUNDED AT END

DEVELOPMENT

1. PURPOSE OF CIRCUIT

- 1.1 This circuit is used to control the routing of calls to the respective line finder selectors and starts an idle selector hunting over the line terminals for the calling line.

2. WORKING LIMITS

- 2.1 None

OPERATION

3. PRINCIPAL FUNCTIONS

- 3.1 To route the call.
- 3.2 To start a selector hunting for the calling line.
- 3.3 To release the trip relay in the associated trip circuit, thus permitting another call to start in any other group.
- 3.4 Each regular starting circuit is equipped with an emergency plug and jack for immediately replacing the regular circuit with emergency circuit at any time.
- 3.5 To test the line finders.
- 3.6 To return to normal.
- 3.7 To free the start circuit.
- 3.8 To light the line group overload lamp when a call is waiting (Z Wiring).

#### 4. CONNECTING CIRCUITS

This circuit will function:

- 4.1 With sender selector type trip circuit arranged for preference switch.
- 4.2 With sender selector type line finder district circuit.
- 4.3 With Line Load control circuit.

#### DESCRIPTION OF OPERATION

#### 5. ORIGINATING CALL

When the receiver at the calling station is removed from the switch-hook, various relays in the line and trip circuits operate, operating the (STA) relay from ground over lead I, terminal 1 and brush of the (G) group distributor selector, break contacts of the (C), (CA) and (SB) relays to battery through the 18-BH resistance in parallel with the winding of the (ST-A) relay. The (ST-A) relay operated, (a) operates (STP-G) magnet, which remains operated until the (ST-A) relay releases (b) short-circuits the 500 ohm winding of the (CA) relay, preventing it from operating and starting a line finder in sub-group (B), while a call is going through, (c) connects ground to lead (K) and (d) closes a circuit over lead (ST) thus starting a line finder hunting for the calling line.

#### 6. STARTING LINE FINDER

As the line finder starts upward a circuit is closed over lead (Y) operating the (GA) relay. The (GA) relay operated, removes ground from lead (ST), locks to ground on the armature of the (ST-A) relay and closes a circuit operating the (STP-A) magnet. This circuit is traced from ground on the make contact of the (ST-A) relay, make contact of the (GA) relay, terminal and brush of the (A-3) arc of the (A) selector, to battery through the winding of the (STP-A) magnet. The (STP-A) magnet remains operated until the release of the (ST-A) relay. Ground is connected to lead (CH) operating the (CA) or (CB) relay when all line finder selectors in a group are off normal. As the line finder continues upward ground is momentarily connected to lead (K), thus releasing a relay in the trip circuit but holding the (STA) relay operated. When the ground is disconnected from lead (K), the (STA) relay releases and (a) opens the locking circuit through the (GA) relay, which releases, (b) opens the circuit over lead (X), (c) opens the circuit through the (STP-G) magnet, which releases and steps the brushes of the (G) group distributor selector to the next terminals, (d) opens the circuit through the (STP-A) magnet, which releases and steps the brushes of the A group distributor



selector to the next terminals (e) removes the short circuit from the 500 ohm winding of the (CA) relay, which does not operate unless all selectors in the group are busy.

#### 7. EMERGENCY RELEASE OF START CIRCUIT

If either the (STA) or the (STB) relay remains operated, due to the failure of the (TR) or (TRL) relay in the trip circuit to be shunted out and released, the (KF) relay operates as soon as the interrupter contacts I, III and V close, and locks under control of the (STA) or (STB) relay. If it remains locked for two seconds, interrupter contacts II and IV close ground to either the (TR) or (TRL) relay in the trip circuit (depending upon whether the call is through the "A" or "B" sub-group), releasing the (TR) or (TRL) relay. When ground is removed by the opening of the interrupter contacts II or IV, the (STA) or the (STB) relay releases, releasing the (KF) relay and restoring the circuit to normal.

#### 8. START CIRCUIT ALARM

The closure of the interrupter contact VI, which occurs at the same time contacts II and IV are closed, while the (KF) relay is operated, operates the (KA) relay. The (KA) relay operated, locks under control of a key, lights a lamp individual to the line finder group and operates an alarm. When Fig. A is used, the lamp and key are located external to the line finder frame. When Fig. B is used, the lamp and key are located on the line finder frame, and relay (KA) operating also grounds lead "PA" to aisle pilot lamp circuit, lighting an aisle pilot lamp and operating an alarm. The operation of the key releases the (KA) relay, extinguishing the lamps and silencing the alarm.

The operation for a call originating in the last 10 lines of a group of 20 will be similar to that already described for the first 10 lines, except that the (ST-B) and (GB) relays are involved instead of the (ST-A) and (GA) relays.

#### 9. ALL S SELECTORS IN ONE SUB-GROUP BUSY

If all the selectors in sub-group "A", for example are busy, the (CA) relay operates over a circuit from ground over lead (CH), 500 ohm winding of the (CA) relay, to battery through the 600 ohm resistance (C). The (CA) relay operated, transfers, the circuit over lead I from the winding of the (STA) relay, to battery through the winding of the (SA) relay and the break contact of the (SB) relay. When a call is now received, the (SA) relay operates in turn operating the (STB) relay. This circuit is traced from battery through the winding of the (STB) relay, make contact of the (SA) relay, 600 ohm resistance (B), to ground on the armature of the (CB) relay. The (STB) relay operated, operates a relay in the district thus starting a selector in the ("B" sub-group hunting for the calling line and closes a locking circuit



through the 100 ohm winding and make contact of the (CA) relay. This is to prevent the release of the (CA) relay should a selector become available in the (A) sub-group while a call is going through the (B) sub-group. If all selectors in sub-group (B) are busy, the operation is similar except that the (CB), (SB), and (ST-A) relays now operate. The (ST-A) relay operated, starts a selector in the (A) sub-group hunting, as explained before.

#### 10. ALL SELECTORS IN BOTH SUB-GROUPS BUSY

If all selectors in both sub-groups are busy, both the (CA) and (CB) relays are operated. Should a call be received in either sub-group under these conditions, the corresponding (SA) or (SB) relay operates, but neither the (STB) nor (STA) relay operates, as the circuits to ground on the armature of the (CA) and (CB) relays are open. When a call is received in the (A) or (B) sub-groups while all selectors are busy, the special message register (MR) in the starting circuit operates through the make contact of the (SA) relay to ground on the armature of the (CB) relay, if the call is in sub-group (A), or through the make contact of the (SB) relay to ground on the armature of the (CA) relay, if the call is in sub-group (B). The message register thus indicates the number of calls which were originated while all the line finder selectors were busy. When line group over-load signal is specified, option Z is used. Operation of the register under this condition connects ground to lead "G". This causes a lamp in the line load control circuit to light indicating an overload condition. When the overload condition is removed the register releases removing ground from lead "G" and extinguishing the lamp.

#### 11. TESTING LINE FINDER SELECTOR

This circuit, which is shown associated with the starting circuit, enables the testing of any particular line finder selector at any time. The test line used with the test box circuit for making the test in the first or bottom line of the bottom bank in both (A) and (B) sub-groups, the first line terminals in both sub-groups being connected together. When the 184 plug (shown on the line finder circuit) is inserted in the test jack of the line finder under test, the (ST) and (ST-1) leads are connected together and the circuit that supplied battery to the (ST) lead is transferred to lead (Z). When the plug of the test box cord is inserted in the test jack, the (A) relay operates from ground on the sleeve of the test box cord. The (A) relay operated opens the circuit over lead (TR) and operates the (B) relay. The (B) relay is slow in operating to prevent a call which has just reached the (STA) or (STB) relay from being interrupted. The (B) relay operated, (a) locks to battery on its make contact (b) operates the (C) and (Cl) relays and (c) closes the ring side of the loop through the test box, which operates



the (L) relay associated with the test line. The (C) relay operated, (a) transfers the circuit for operating the (STA) relay from the (G) distributor selector bank, (b) opens the normal (ST) lead, (c) connects ground to lead (Z), (d) opens the operating circuit for the (ST-B) relay, which would otherwise operate and lock on a call within the last 10 lines in the group. The (CI) relay operated, (a) closes a circuit over the (TR) lead from battery on the armature of the (STP-G) magnet, (b) connects the (K) lead of sub-group (A) with the (K) lead of sub-group (B), thus connecting the (K) commutator segments of all the selectors of both sub-groups together, (c) connects the (Y) lead of sub-group (A) with the (Y) lead of sub-group (B), so that the (GA) relay will be operated by a selector in either sub-group. When the (L) relay in the test line operates, the trip circuit functions and connects ground through a relay in trip circuit, over lead (TR), make contact of the (CI) relay, break contact of the (STA) and (STB) relays to battery on the contact of the (STP-G) magnet, operating the relay in the trip circuit. When the relay in the trip circuit operates, it locks over lead I, make contact of the (C) relay, break contacts of the (CA) and (SB) relays to battery through the winding of the (STA) relay in parallel with the 18-BH resistance, operating, the (STA) relay. The (STA) relay operated, operates the (STP-G) magnet which remains operated until the (STA) relay releases, (b) short-circuits the 500 ohm winding of the (CA) relay (c) connects ground to lead (K), (d) operates the (D) relay and (e) closes a circuit from ground through the break contact of the (GA) relay, make contact of the (C) relay over lead (Z) to battery through a relay in the district thus causing the line finder to start hunting for the calling line. The (D) relay operated, locks to ground on the armature of the (A) relay. When the (STA) relay releases, the (E) relay operates from ground on the left armature of the (STA) relay, make contact of the (D) relay, to battery through the break contact and winding of the (E) relay. The (E) relay operated, (a) locks to ground on the armature of the (A) relay, (b) releases the (C) and (Cl) relays, thereby restoring the starting circuit to normal, (c) closes the circuit from battery on the armature of the (STP-G) magnet, which was opened by the operation of the (A) relay and later closed by the operation of the (Cl) relay, through to the (TR) lead. When the plug of the test box cord is removed from the test jack, the (A) relay is released, releasing the (B), (D) and (E) relays, thereby restoring the test circuit to normal.

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APP'D.  
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